**Core IX** **Igneous Petrology**

**Course Objectives**

- To introduce Igneous processes and products
- To classify the various igneous rocks based on their genesis, mineral composition and texture
- To analyze the petrographic characteristics and processes of igneous rocks:
- To interpret rock characteristics to deduce the magmatic processes, including magma differentiation, fractional crystallization, assimilation, and magma mixing.

**Learning Outcomes:**

- Understand the basis for classification and nomenclature of igneous rocks:
- Identify igneous rocks based on their mineral composition, texture, and mode of occurrence.
- Evaluate the petrographic characteristics and interpret the igneous processes involved.
- Deduce the magmatic processes, including magma differentiation, fractional crystallization, assimilation, and magma mixing

**Unit - I: Introductory Concepts**

Magma generation in the crust and upper mantle. Physical properties of magma - temperature, viscosity, density and volatile content. Modes of emplacement of igneous rocks: volcanic, hypabyssal, plutonic

**Unit - II: Forms, Texture and Microstructure**

Mode of occurrence of igneous rocks. Forms of igneous rocks. Crystallinity, granularity, shapes and mutual relations of grains; nucleation and growth of minerals in magma; Different textures and microstructures and their occurrence ( e.g. panidiomorphic, hypidiomorphic, allotriomorphic, porphyritic, vitrophyric, poikilitic, ophitic, sub-ophitic, intergranular, intersertal, pilotaxitic, trachytic, graphic, granophyric, rapakivi, orbicular, corona, perthitic, myrmekitic, variolitic, speherulitic and spinifex.) Bowen's reaction series, differentiation and assimilation of magma and diversity of igneous rocks.

**Unit - III: Classification and Petrographic Analysis**

Bases of classification of igneous rocks: mineralogical, textural, chemical, chemico-mineralogical and associational. Norm and mode. Standard classification schemes – Niggli, Hatch and Wells and IUGS. TAS diagram for volcanic rocks; Petrography of important igneous rocks (felsic, mafic, ultramafic and Alkaline)

**Unit - IV: Phase Diagrams**

Phase rule and its application to eutectic, peritectic and solid solution system. Phase equilibria in the following binary and ternary systems under high dry and wet pressure with respect to their nature under low pressure, and their petrogenetic significance: diopside – anorthite, forsterite – silica, albite – anorthite, albite – orthoclase, diopside – albite – anorthite, forsterite – diopside – silica and nepheline - kalsilite – silica.

**Practical:**

- Megascopic identification of important igneous rocks.
- Microscopic identification of important igneous rocks

**Textbook:**


- ✓ *Winter, J. D. (2014). Principles of igneous and metamorphic petrology. Pearson.*
- ✓ *Hota, R.N.(2017) Practical approach to petrology, CBS Publishers and Distributors, New Delhi*

**Suggested readings:**


- ✓ *Rollinson, H. R. (2014). Using geochemical data: evaluation, presentation, interpretation. Rout ledge.*
- ✓ *Raymond, L. A. (2002). Petrology: the study of igneous, sedimentary, and metamorphic rocks. McGraw-Hill Science Engineering.*
- ✓ *Myron G. Best (2001). Igneous and Metamorphic Petrology*
- ✓ *Bose M.K. (1997). Igneous Petrology.*
- ✓ *G W Tyrrell. (1926). Principles of Petrology. Springer*